Harmonic™

HARMONIC® GENERATOR 300

Advanced Troubleshooting Guide

Transforming Patient Care Through Innovation™

ETHICON ENDO-SURGERY
a Johnson & Johnson company

This Troubleshooting Guide will help you to support the HARMONIC® Generator 300 system.

Whenever a problem occurs on the HARMONIC® Generator 300 system, refer to the specific section listed on the index page.

Should you still have trouble pinpointing the issue after consulting the respective section, contact us at 1-800-USE-ENDO

Note that this manual may be subject to revisions. Please ensure that you are referring to the latest version.

The Advanced Troubleshooting Guide is intended as an adjunct to the instructions for use. Before using the device, read full instructions for use.

GEN04
Harmonic® Generator 300

HP054
Hand Piece

HPBLUE
Hand Piece

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1 HARMONIC® GENERATOR 300

The HARMONIC® Generator 300 System supports a series of audible and visual alarms, as well as error codes displayed on the unit's LCD, to help in identifying and troubleshooting problems. This guide is meant as an adjunct to, but not a substitute for, clinical judgment and observations. If the problem cannot be resolved using the corrective actions contained within this troubleshooting guide, contact 1-800-USE-ENDO. Please have the model number, serial number from the rear panel of the generator, and a detailed description of the problem. The description of the problem should include power settings, accessories used, procedure being performed, and software version of the unit.

1.1 Generator Power-Up Problems

Ensure the generator unit is plugged into a functioning wall outlet and that the power cord is attached to the rear panel of the generator. If the unit still does not respond, have a biomedical engineer verify that the fuses are intact and properly installed.

Note:
There are both external and internal fuses in the generator unit. Refer to the Replacement Parts drawings in the back of the system service manual for fuse locations.

1.2 Audible Indicators and Alarms

Tone	Possible Cause and Corrective Action
No tone during power-up.	Generator failure. Contact 1-800-USE-ENDO.
No tone when system is activated	• Confirm hand activation is enabled if hand-switching adaptor or hand activation is being used. • Confirm foot switch is fully connected (if hand switching adaptor or hand activation is not being used). • Confirm foot switch is not faulty. • If hand-switching adaptor is used, confirm it is connected and not faulty.
Activation (brief pulses)	System is being activated or is in Test mode. System is operating properly. MIN and MAX power have unique tones.
Alert (three-tone sequence)	• Activation is attempted while generator is in Standby mode. Push the STANDBY button to return the generator to Ready mode. • Two or more foot or hand activation switches are recognized by the generator as being activated simultaneously. Release all activation switches and reactivate using only one switch.
Constant tone	**1.** Instrument is in contact with too much tissue. Reduce the amount of tissue in contact with the instrument. If tone persists, carefully remove any tissue that has collected in the distal end of the instrument shaft. **2.** Hand piece and/or blade fault. Press TEST to identify source of fault.
Prolonged solid tone during activation (10s)	• Hand piece and/or blade fault. Press TEST to identify source of fault.
Alarm (two-tone sequence)	• A component or system problem has occurred. Refer to the Error Codes section Guide. *Note: This alarm will activate for three seconds, then will silence itself for 30 seconds. This cycle will continue until the error is resolved or the main power switch is turned off.*

1.3 Main Error Codes and Displays

The generator will recognize specific faults in five areas: generator, hand piece, instrument, foot switch or hand switch. When a fault is identified, an alarm will sound, the error number will appear on the generator control panel, and the source of the problem will appear on the graphic display (the power levels will not be displayed).

Note:
For each error code, the generator will cycle between each of the two screens shown in the examples below, with the faulty component flashing.

Follow the procedures outlined within this troubleshooting guide (or in the Troubleshooting Guide on the top of the generator unit) to resolve the problem.

1.4 Error Code 1: Generator

Generator Error Code 1 indicates that either there is a functional problem with the generator or the front panel button(s) were activated during power-up sequence.

Cycle the power OFF then ON. If error persists, power the system off and contact 1-800-USE-ENDO.

Fig. 1 Generator failure screen

1.5 Error Code 2: Generator Temperature

Error Code 2 indicates that the generator is overheating.

1. Power the system off. Remove any obstructions blocking the air vents on the generator's bottom and back panels. If there is no apparent obstruction or external heat source, contact 1-800-USE-ENDO.

2. Power on the system and wait for up to 30 minutes for the generator error to clear.

3. If the error code persists, contact 1-800-USE-ENDO.

Fig. 2 Generator over temperature screen

1.6 Error Code 3: Hand Piece

Error Code 3 indicates a problem with the hand piece.
Please also refer to “HP054” or “HPBLUE” hand piece section.

1. Confirm the hand piece connector is fully inserted and properly oriented – white dot on hand piece is aligned with white dot on front panel. If the error code does not clear within three seconds after the hand piece is properly connected, press TEST.

2. The instrument may not be tightened properly or tissue may have collected in the distal end of the instrument shaft. Tighten instrument using torque wrench and carefully remove tissue from distal end of instrument sheath. Press STANDBY to clear error code and return to Ready mode. Activate system. If the pre-run test is running, ensure instrument is in air. If using shears, ensure jaws are open and not in contact with any objects during pre-run test.

Note:
For HP054:
Inspect the torque wrench hub for cracks or wear before use. If damage is seen, replace the blade wrench. Before using after autoclaving, cool the blade wrench at room temperature for at least 45 minutes or soak it in room temperature sterile water for 5 minutes. Please loosen the instruments with the blade wrench.

3. If the error persists, install a test tip to isolate the problem. Press TEST button.
   - If system indicates a hand piece error, hand piece is bad or test tip is bad. Replace hand piece or install a new test tip and press TEST.
   - If no error occurs with test tip attached, replace instrument.
   - Press STANDBY to return to Ready mode. Activate system.

Fig. 3 Hand Piece generic error screen

1.7 Error Code 4: Hand Piece Temperature

Error Code 4 indicates that the hand piece has exceeded its specified operating temperature. This error code pertains to the HP054 only.

For immediate recovery use another hand piece, or follow the steps below to determine the cause of the error condition and recovery methods.

The following are possible causes of an increase in hand piece temperature. To correct this condition, complete the appropriate steps below and *allow the hand piece to cool before resuming operation*.

1. The hand piece is still warm from recent steam sterilization. Allow the hand piece to cool at room temperature for at least 45 minutes

Note:
The hand-switching adaptor (HSA07) should not be submerged for rapid cooling purposes. This may render the hand switching adaptor inoperable for an extended period of time. After steam sterilization, allow the hand switching adaptor to air cool at least 15 minutes prior to use.

2. If the error persists, install a test tip to isolate the problem. Press TEST button.

    - If system indicates a hand piece error, hand piece is bad or test tip is bad. Replace hand piece or install a new test tip and press TEST.
    - If no error occurs with test tip attached, replace instrument.

3. Press STANDBY to return to Ready mode. Activate system.

4. If the hand piece does not show evidence of overheating and troubleshooting steps 1-3 do not appear to resolve the problem, perform the following:

   - Leave the hand piece at room temperature for 24 hours or more.
   - Remove any test tip or instrument from the hand piece.
   - With the generator turned off, plug the hand piece into any Generator 300.
   - Power up the generator in Biomed mode while pressing and holding down the STANDBY button and down arrow.
   - Wait for a steady display – approximately 10 seconds.
   - If a "Generator" error occurs one of the buttons was not properly held down. If this happens repeat the power up procedure in Biomed mode.
   - If necessary, press the STANDBY button until it illuminates.
   - Use the up and down arrows to get to "Page 2 of 21".
   - Record the number opposite "XDUCER CAPACITANCE".

- Press the STANDBY button until the Standby light turns off.
- Leave the hand piece plugged into the generator. Do not remove hand piece during entire procedure. Do not activate the MIN or MAX activation buttons on the foot switch or hand switch if either is attached.
- After 30 or more minutes, press the STANDBY button until the STANDBY icon is illuminated.
- Again, read the "XDUCER CAPACITANCE" on Page 2 of 21.
- If the number has changed, the update was successful.
- If the number has not changed, then this update attempt did not succeed. Power down the generator and repeat this procedure.

Note:
As the hand piece ages, the generator performs measurements and updates a key hand piece parameter. This function is performed when the internal temperature of the hand piece is stable at room temperature. Certain usage patterns may prevent this update from occurring and subsequently make the hand piece diagnostics more sensitive to temperature. The steps above will cause an update of the hand piece parameter and return the system to designed sensitivity.

Do not run the Test mode while an electrosurgical generator is being activated in the room. Interference from the electrosurgical generator may affect test results.

Warning:
To avoid user or patient injury, ensure that the instrument is clear of the patient, other instruments, drapes, or other objects before pressing TEST. Safety measures (in accordance with hospital protocol) taken in the presence of aerosols should be in effect while in Test mode.

Fig. 4 Hand Piece over temperature error screen

1.8 Error Code 5: Instrument

Error Code 5 indicates a problem with the instrument.

The instrument may not be tightened properly or tissue may have collected in the distal end of the instrument shaft. Tighten instrument using proper torque wrench.
Remove tissue from distal end of instrument sheath by activating it in sterile water. Press STANDBY to clear error code and return to Ready mode. Activate system. If the pre-run test is running, ensure instrument is in air. If using shears, ensure jaws are open and not in contact with any objects during pre-run test.

Please loosen the instrument with the torque wrench.

If the error persists, install a test tip to isolate the problem. Press TEST button. If system indicates a hand piece error, hand piece is bad or test tip is bad. Replace hand piece or install a new test tip and press TEST. You can also refer to the hand piece sections (HP054 and HPBLUE). If no error occurs with test tip attached, replace instrument.

- Press STANDBY to return to Ready mode. Activate system.

Warning:
To avoid user or patient injury, ensure that the instrument is clear of the patient, drapes, other instruments, or other interference before pressing TEST. Safety measures (in accordance with hospital protocol) taken in the presence of aerosols should be in effect while in Test mode.

Note:
Do not run the Test mode while an electrosurgical generator is being activated in the room. Interference from the electrosurgical generator may affect test results.

Fig. 5
Instrument generic screen

1.9 Error Code 6: Foot Switch

Error Code 6 indicates a foot switch pedal is stuck in the ON position.

Confirm generator receptacle, foot switch receptacles and cable connectors or foot switch cable are connected correctly. In most cases, the foot switch cable is broken due to repeatedly having it wrapped around the foot switch. The foot switch cable is available for ordering as a spare part.

Fig. 6 Footswitch assembly error screen

Note:
If the error persists, replace the foot switch or the footswitch cable. If you have a sporadic footswitch error, keep the MAX pedal pressed while moving the footswitch cable on the switch side. If you get error code 6, replace the footswitch cable.

1.10 Error Code 7: Hand Switch

Error Code 7 indicates the hand switch is stuck in the ON position.

Confirm contacts in the distal end of hand piece and in the proximal end of the hand-switching adaptor are dry or replace the hand-switching adaptor.

Note:
If the error persists, replace hand switch. Confirm that the two contact springs are in place and in a good condition!

Fig. 7 Hand Activation Assembly error screen

The hand-switching adaptor (HSA07) should not be submerged for rapid cooling purposes. This may render the hand switching adaptor inoperable for an extended period of time. After steam sterilization, allow the hand switching adaptor to air cool at least 15 minutes prior to use.

Note:
The hand-switching adaptor (HSA07) is not compatible with the HPBLUE.

1.11 Generator Testing: Function Test

1. Attach the hand piece to the generator. Ensure the test tip is attached correctly. Make sure the torque wrench works well.

2. Switch the generator ON.

3. Verify that the orange STANDBY indicator is illuminated.

4. Push the STANDBY button to leave Standby mode and enter Ready mode.

Note:
In the Ready mode, the system periodically sends a low-amplitude signal to the blade for self-diagnostic purposes, causing the blade to vibrate slightly. This vibration does not pose a risk to the user.

5. Verify that the green READY indicator is illuminated.

6. Verify that MIN Power Level 3 and MAX Power Level 5 are displayed.

7. Push the Increase and Decrease Power Level button up and down to confirm the MIN Power Level changes from 1 to 5.

8. Turn the generator off. Wait five seconds, then turn the generator back on. Wait ten seconds, then confirm MIN Power Level 3 and MAX Power Level 5 are displayed.

9. Confirm the generator is not being activated inadvertently.

10. Connect a test tip to the hand piece. Press the TEST button to perform a user-initiated test. The system will run a series of tests to ensure the generator and hand piece are in proper working condition.

11. Place the generator in Ready mode by pressing the STANDBY button. Hold the hand piece so that the distal part is in the air and step on the MAX foot switch pedal. (Before activation begins, a five-second system check will be performed – TEST IN PROGRESS will appear on the display.) After the test is completed, verify that the MAX Power Level indicator on the control panel flashes and that the MAX activation tone is heard.

Warning:
To avoid user injury, ensure that the test tip is clear of tissue, other instruments, or other objects before activating the system.

12. Hold the hand piece so that the distal part is in the air and step on the MIN foot switch pedal. Verify that the MIN Power Level indicator on the control panel flashes and that the MIN activation tone is heard.

Warning:
To avoid user injury, ensure that the test tip is clear of tissue, other instruments, or other objects before activating the system.

1.12 Service Mode for Generator Testing

How to enter:

Power up generator and firmly press the STANDBY and DOWN ARROW buttons simultaneously until the BME service mode appears.

Caution:
Make sure to press BOTH buttons simultaneously, otherwise Generator "Error code #1" will appear (which will require you to power the generator down and then back up).

Operation in BME mode is identical to normal mode except for:

- The up and down arrows are used to advance through pages (1-21).
- LCD display.
- Clearing an error requires two presses of STANDBY in BME mode and only one press in normal mode.

1.13 Generator 300 Test in BME Mode

Check the generator's current output:

1. Power the generator off. Wait 10 seconds.

2. Power the generator on while firmly pressing both STANDBY and DOWN ARROW buttons simultaneously. Continue to press and hold the two buttons until page number 1 of the BME display mode is visible (Service mode) and only the STANDBY indicator is lit.

   A generator "Error Code #1" will result if the two buttons are not continuously pressed as described and the generator will have to be powered down and back up again.

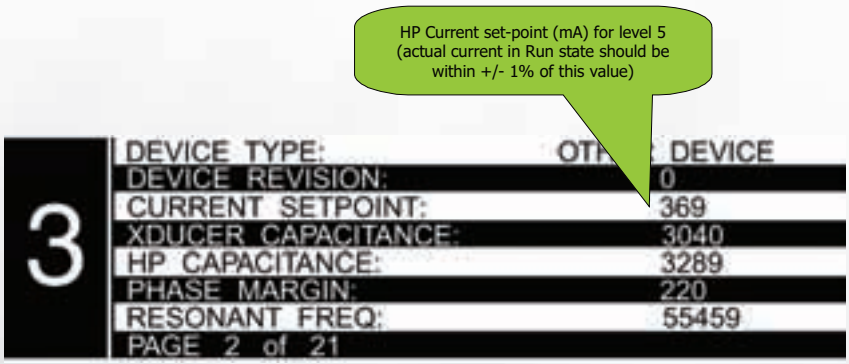
3. Connect a HP054 hand piece which you know is in good condition to the generator.

Note:
Make sure the hand piece is not hot (i.e., at room temperature).

4. Attach test tip using torque wrench to the hand piece.

5. Use the up and down arrows to scroll to page 2 of the BME service mode.

6. Record the current Set point value for the hand piece listed on page 2 of the BME service mode (in STANDBY mode).


HP Current set-point (mA) for level 5 (actual current in Run state should be within +/- 1% of this value)
3
DEVICE TYPE: OTH DEVICE
DEVICE REVISION: 0
CURRENT SETPOINT: 369
XDUCER CAPACITANCE: 3040
HP CAPACITANCE: 3289
PHASE MARGIN: 220
RESONANT FREQ: 55459
PAGE 2 of 21

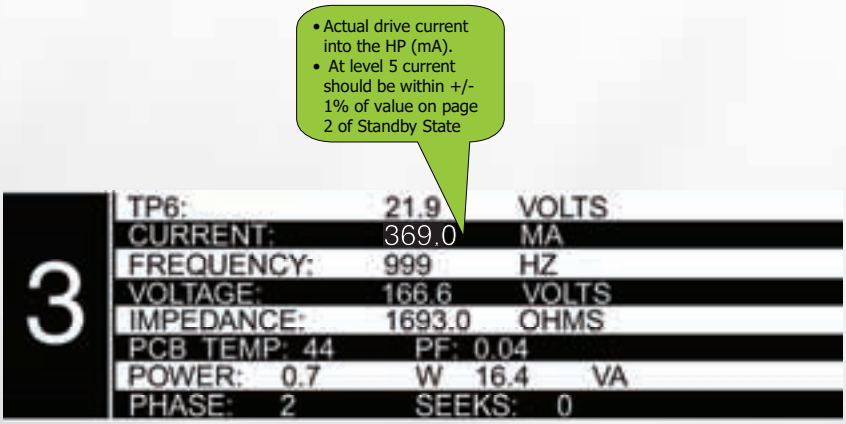
Current Setpoint = _____

7. Press STANDBY key to enter Ready state.

8. Press the Hand Activation button if using hand switching adaptor HSA07. Activate at level 5 by pressing the "MAX" foot switch pedal or "MAX" switch on the hand switching adapter while keeping the test tip in air.

9. Allow the pre-run test is complete. To ensure the pre-run test has completed, terminate activation after regular "MAX" activation beeps are audible.

10. Reactivate the device and record the current on the display while continuing to activate on level 5.


• Actual drive current into the HP (mA).
• At level 5 current should be within +/- 1% of value on page 2 of Standby State
3
TP6: 21.9 VOLTS
CURRENT: 369.0 MA
FREQUENCY: 999 HZ
VOLTAGE: 166.6 VOLTS
IMPEDANCE: 1693.0 OHMS
PCB TEMP: 44 PF: 0.04
POWER: 0.7 W 16.4 VA
PHASE: 2 SEEKS: 0

Note:
The screen will appear different until you activate on "MAX" power level 5. The numbers will fluctuate until you activate the instrument. Please be sure to capture reading while the instrument is activated.

Current = _____

Note:
The current read should be within +/- 1% of the current recorded on page 2 of the standby screen display. If the values are out of tolerance, check for the last date of calibration.

If a calibration is necessary, contact 1-800-USE-ENDO or a "level1+" (closed box, incl. calibration) trained biomedical engineer who can perform the calibration.

If the Generator 300 passes the above steps it is very likely functioning properly.

For further testing please refer to section "HP054", or "HPBLUE" section.

1.14 GEN04 Calibration Procedure

1.14.1 Calibration One (Write Current Calibration)

This section describes the requirements for calibrating the output current level of the Generator.

Required Equipment:

Digital MulitMeter (DMM)

- 4 digits minimum
- 300Khz bandwidth minimum
- True RMS voltage
  - Minimum Accuracy
  - True RMS AC Voltage
    (Voltage Range 100 – 1000mV, 23°C +/- 5°C)
  - 3 – 5hz: 1.00%of reading + 0.04% of range
  - 5 – 10hz: 0.35% of reading + 0.04% of range
  - 10 – 20Khz: 0.06% of reading + 0.04% of range
  - 20 – 50Khz: 0.12% of reading + 0.04% of range
  - 50 – 100Khz: 0.60% of reading + 0.08% of range
  - 100 – 300Khz: 4.00% of reading + 0.50% of range

Note 1
For best accuracy, take the measurements required in step16 & step 27 of the procedure ONLY as follows:

a. One test lead of the DMM touching R234 on the side that doesn't connect to R233. This lead will need to be held in place manually as there is nothing to connect an alligator clip to. (For best accuracy, do not clip to C177 or any other node connection point on the circuit board.)

b. The second test lead can be clipped to R229 on the lead that is connected directly to R233.

Note 2
"Power up into BME Mode" includes taking the following steps – which are also contained in the service manual (included here for reference):

a. Power down unit.
b. Wait 5 seconds.
c. Power up Unit while simultaneously holding the STANDBY and DOWN ARROW keys.

Procedure:

1. Remove the generator cover.
2. Connect the foot switch assembly to the generator or mount the hand switching adapter onto the handpiece.
3. Connect the hand piece to the generator.
4. Attach a test tip to the hand piece, and torque on using a torque blade wrench.
5. Power up the generator into BME Mode.
6. Scroll to page 2.

7. Record the Current Setpoint value: _____ mA

8. By specification, 75 percent of the value recorded in step 7 is the anticipated Level 3 current. Calculate and record this value by **multiplying** the step 7 value above, by **0.75**.

_____ mA

9. Scroll to Page 17.
10. Turn the volume knob fully to the left (counter-clockwise).
11. Press the TEST key repeatedly until Value Not Accepted is flashed on the display.

Fail____ Pass____

12. The unit is now intentionally uncalibrated. This can be verified by scrolling to Page 21 and inspecting the Current Write Cal – the value should be 5060.

Fail _____ Pass _____

13. Put the generator into BME Ready state by pressing the STANDBY Key.
14. Ensure the test tip is prepared to activate in air and is not in contact with anything during activation.
15. Activate at level 3 by pressing the MIN footswitch or hand switching adapter buttons.
16. After the pre-run test is complete, continue activating at level 3, and measure the VAC RMS across the series combination of R233 and R234, using the Digital Multimeter (DMM). Record the value to four digits of precision.

_____ mA

17. Deactivate the hand piece by releasing the foot switch or hand switch button.
18. Put the generator into BME Standby State by pressing the STANDBY Key.
19. Scroll to Page 17.
20. By turning the volume knob, dial in the value read on the DMM in step 16. (a number is displayed on the LCD, which changes as the knob is turned).
21. Press the TEST key one time (only one time). Value Accepted should flash.

Fail _____ Pass _____

22. Power off the unit for at least 5 seconds.
23. Power up the generator into BME Mode.

24. Put the generator into BME Ready State by pressing the STANDBY Key.
25. Ensure the test tip is prepared to activate in air and is not in contact with anything during activation.
26. Activate at level 3 by pressing the MIN footswitch or hand switching adapter buttons.
27. After the pre-run test is complete, continue activating at level 3, and measure the measure the VAC RMS across the series combination of R233 and R234, using the DMM as in step 16 above. Record the value to four digits of precision:

_____mA

28. Verify the current in step 27 is within 1 percent of the value calculated in step 8. If not, carefully re-execute this test procedure again.(up to three times)

Fail____ Pass____

29. Power OFF the generator for at least 5 seconds and continue to the CALIBRATION TWO procedure.

2. Calibration Two (Read Current Calibration)

This section describes the requirements for calibrating the monitored (read) current level of the GEN04 Generator.

Note:
Power up into BME Mode includes taking the following steps which are also contained in the service manual (included here for reference):

- ***a. Power down unit.***
- ***b. Wait 5 seconds.***
- ***c. Power up Unit while simultaneously holding the STANDBY and DOWN ARROW keys.***

Procedure:

1. Power up the generator into BME Mode.
2. Scroll to Page 2.
3. Record the Current Setpoint value: _____mA

4. By specification, 75 percent of the value recorded in step 3 is the anticipated Level 3 current. Calculate and record this value by **multiplying** the step 3 value above, by **0.75**.

_____mA

5. Put the generator into BME Ready State by pressing the STANDBY Key.
6. Ensure the test tip is prepared to activate in air and is not in contact with anything during activation.
7. Activate at level 3 by pressing the MIN footswitch or MIN hand switching adapter buttons.

8. Continue activating the generator at level 3 for at least 1 second after the pre-run test is complete.
9. Deactivate the hand piece by releasing footswitch or hand switching adapter buttons.
10. Put the generator into BME Standby State by pressing the STANDBY Key.
11. Scroll to page 18.
12. Press the TEST key one time (only one time) to accept the calibration current value.
13. The text Value Accepted! should flash if the calibration procedure was successful.

Fail____ Pass____

14. Record the current displayed on the screen.

_____mA

15. Power the unit off for at least 5 seconds.
16. Power the unit into BME Mode.
17. Enter BME Ready State by pressing the STANDBY Key.
18. Ensure the test tip is prepared to activate in air and is not in contact with anything during activation.
19. Activate at level 3 by pressing the MIN footswitch or MIN hand switching adapter buttons.
20. Continue activating the generator at level 3 for at least 1 second after the pre-run test is complete.

21. Deactivate the hand piece by releasing footswitch or hand switching adapter buttons.
22. Go to BME Standby State by Pressing the STANDBY Key.
23. Scroll to page 18.
24. Record the I (LEVEL 3) current displayed on page 18.

_____ mA

25. Verify that the reading is within 1 percent of the value calculated in step 4. If not, carefully re-execute both CALIBRATION ONE & CALIBRATION TWO procedures again.(up to three times)

Fail____ Pass____

26. Power OFF the Generator.

1.15 Error Display Mode (SW 1.09)

How to enter:

Power up generator and firmly press the STANDBY and UP ARROW buttons simultaneously until error display mode appears.

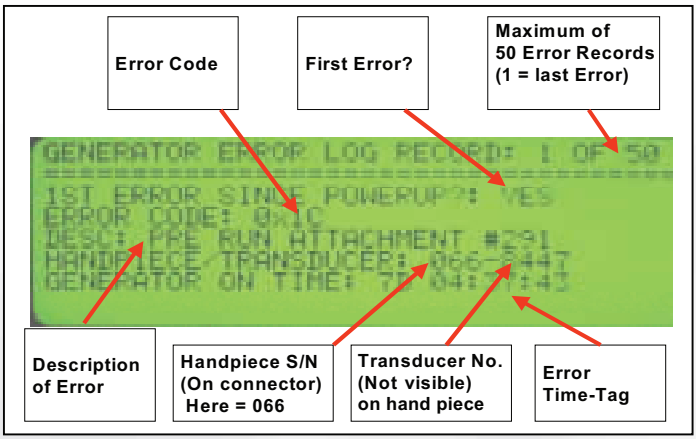

Error Code
First Error?
Maximum of 50 Error Records (1 = last Error)
Description of Error
Handpiece S/N (On connector) Here = 066
Transducer No. (Not visible) on hand piece
Error Time-Tag

Fig.16 Error display- Modus: Generator Errors

Note:
– This error display mode will display the last 50 errors.
– Use the up and down arrows to scroll through the pages.
– Does not require a hand piece to be connected.
– Can be used to track problematic hand pieces.

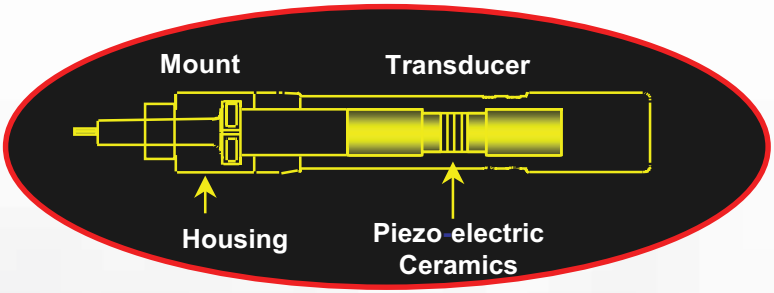
1.16 Specific Error Codes

Error code	Message hidden in code	Component	What to do?
09	FS1_SHORTED_PRESENT_FAULT	FSW01	Check connection & cable
0A	FS2_SHORTED_PRESENT_FAULT	FSW01	Check connection & cable
0B	FS1_SHORTED_NOT_PRESENT_FAULT	FSW01	Check connection & cable
0C	FS2_SHORTED_NOT_PRESENT_FAULT	FSW01	Check connection & cable
10	FS2_SHORTED_PRESENT_FAULT	FSW01	Check connection & cable
11	HP_ACTIVATION_SHORTED_FAULT	HSA07	Check connection and spring
16	FET_SOA_FAULT	Instr.	Check HP054, change instr., check GEN
17	HP_GUNKED_BLADE_329	Instr.	Check HP054, change instr.
18	HP_MULTI_LEVEL_GUNK_BLADE_264	Instr.	Check HP054, change instr.
19	HP_LOOSE_BLADE_STUD_FAULT_257	Instr.	Check HP054, change instr.
1A	HP_TEST_WO_BLADE_FAULT_258	Instr.	Check HP054, change instr.
1B	HP_W_BAD_BLADE_262	Instr.	Check HP054, change instr.
1C	HP_PRE_RUN_ATTACHMENT_291	Instr.	Check HP054, change instr.
1D	HP_PRERUN_BROKEN_BLADE_284	Instr.	Check HP054, change instr.
1E	HP_RUN_BROKEN_BLADE_FAULT_320	Instr.	Check HP054, change instr.
1F	LUMPED_PARMS_FAULT_283	Instr.	Check HP054, change instr.
20	MULTI_LEVEL_FAULT_281	Instr.	Check HP054, change instr.
21	GENERIC_AT_RES_BLADE_FAULT	Instr.	Check HP054, change instr., check GEN
22	GENERIC_PRERUN_FAULT	Instr.	Check HP054, change instr., check GEN
2E	HP_DATA_FAULT	HP054	Check hand piece
2F	HP_NOT_PRESENT_FAULT	HP054	Check HP054 connector
38	PRESENT_NOT_HP_FAULT	HP054	Check HP054 connector
39	NON_EES_HP_FAULT	HP054	Check HP054
3A	UNAUTHORIZED_HP_FAULT	HP054	Check HP054
3B	INVALID_HP_PARM_FAULT	HP054	Check HP054
3C	HP_PRESENT_NO_FET_BIAS_FAULT	HP054	Check HP054
3D	HP_OFFRES_C0_MEASUREMENT_FAULT	HP054	Check HP054
4C	HP_PRE_RUN_TRANSVERSAL_324	HP054	Check HP054
4D	HP_HIGH_C0_RATE_OF_CHANGE_293	HP054	Check HP054
4E	HP_END_OF_LIFE_292	HP054	Check HP054

4F	BAD_HP_W_TEST_TIP_FAULT_258	HP054	Check HP054
50	UNSTABLE_OUTPUT_FAULT	HP054	Check HP054
51	HP_SHORTED_FAULT_253	HP054	Check HP054
52	HP_OPEN_FAULT_254	HP054	Check HP054
53	RUN_HP_SHORTED_FAULT	HP054	Check HP054
65	HP_OVER_TEMP_RES_FAULT	HP054	Check HP054
66	HP_OVER_TEMP_319	HP054	Check HP054
6F	HS_OVERTEMP_FAULT	GEN300	Send in for service
70	PCB_OVERTEMP_FAULT	GEN300	Send in for service
97	ADC_FAILURE	GEN300	Send in for service
98	FET_BIAS_FAILURE	GEN300	Send in for service
99	HANDPIECE_ID_FAILURE	GEN300	Check hand piece
9A	SCI_FAILURE	GEN300	Send in for service
9B	BEZEL_SWITCH_STUCK_FAILURE	GEN300	Send in for service
9C	EE_FAILURE	GEN300	Send in for service
9D	EE_TIMEOUT_FAILURE	GEN300	Send in for service
9E	AUD_TIMEOUT_FAILURE	GEN300	Send in for service
9F	WATCHDOG_FAILURE	GEN300	Send in for service
A0	NMI_ISR_FAILURE	GEN300	Send in for service
A1	PHANTOM_ISR_FAILURE	GEN300	Send in for service
A2	ROM_CRC_FAILURE	GEN300	Send in for service
A3	DATA_MEM_FAILURE	GEN300	Send in for service
A4	DSP_CORE_FAILURE	GEN300	Send in for service
A5	DISPLAY_FAILURE	GEN300	Send in for service
A6	POWER_SUPPLY_FAILURE	GEN300	Send in for service
A7	SOFTWARE_INT_FAILURE	GEN300	Send in for service
A8	MITIGATION_FAILURE	GEN300	Send in for service
A9	STR_VAL_OUT_OF_BOUNDS_FAILURE	GEN300	Send in for service
AA	UNKNOWN_FAILURE	GEN300	Send in for service
AB	OVERCURRENT_FAILURE	GEN300	Send in for service
AC	ILLEGAL_ADDR_FAILURE	GEN300	Send in for service
AD	SPI_FAILURE	GEN300	Send in for service
AE	AUDIO_FAILURE	GEN300	Send in for service
AF	STACK_FAILURE	GEN300	Send in for service
B0	VLVL_MITIGATION_FAILURE	GEN300	Send in for service

2 HARMONIC® Hand Piece HP054

The generator drives the piezo ceramics by an electronic alternating signal. The piezo ceramics of the hand piece change the electronic signal into an alternating mechanical movement.



For the advanced Harmonic® system to work efficiently, all components, e.g. the generator, hand piece and instrument have to function "harmonically". The generator continuously monitors the performance of the system components and measures the feedback from the hand piece.

After completing the screening process from this troubleshooting guide, you will be certain on whether your hand piece is working well or not.

You have to use a calibrated Harmonic® GEN 300 for testing hand pieces.

Follow the screening process very carefully.

2.1 Screening of Hand Piece HP054

1. Attach test tip using torque wrench onto the hand piece.

2. Check whether the mount is loose within the hand piece housing. To have a better lever and thus a clearer result, hold the hand piece with one hand and with the other gently attempt to move the test tip while the hand piece housing remains unmoved. If the mount is loose within the hand piece housing, the hand piece is defective and subsequent testing is not required.

Note:
Testing and/or operating a hand piece with a loose mount may result in various error codes being displayed (e.g. Error-Code-3 (hand piece) or Error-Code-5 (instrument) or Error-Code-4 (hand piece temperature).

Make sure the test tip is not visibly damaged.

3. Connect the hand piece to the generator.

4. Perform a user-initiated test by pressing the TEST button. If an error is detected the hand piece is defective and subsequent testing is not required.

2.2 Service Mode for Hand Piece Testing

How to enter:

Power up generator and firmly press the STANDBY and DOWN ARROW buttons simultaneously until the BME service mode appears.

Caution:
Make sure to press BOTH buttons simultaneously, otherwise Generator "Error code #1" will appear (which will require you to power the generator down and then back up).

Operation in BME mode is identical to normal mode except for:

- The up and down arrows are used to advance through pages 1-21.
- LCD display.
- Clearing an error requires two presses of STANDBY in BME mode and only one press in normal mode.

2.3 Record the value HP Procedures

HP procedures can be found on page 1 of the BME service mode.

Perform the following while the generator is on standby:

For HP054, HP procedures displays the number of procedures in which the hand piece has been used. When you activate the hand piece 10 times within one power on phase, this will subtract one procedure.

Note:
In order to record the number of procedures, perform the following calculation: 65,530 minus the # listed on the display. If the value of HP procedures is getting close to 64,435 (95 procedures), the hand piece is getting close to the end of it's useful life.

However, we have seen the HP054 hand pieces go beyond 95 procedures with proper care and handling.

3
GEN ON-TIME 1D 00:00:00
HP ON-TIME @ MAX 0D 00:00
HP ON-TIME @ MIN 0D 00:00
HP PROCEDURES 65529
HP FAULTS 00 00 00 00 00
GEN FAULTS 2E 51 2E 2E 52
52 52 2E 2E 1A
PAGE 1 of 21

Number of procedures _____

2.4 Record the value of PM (Phase Margin)

Phase margin can be found on page 8 of the BME service mode.

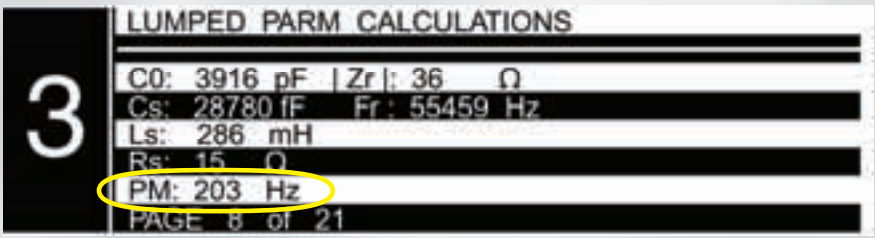
In order to record the phase margin of the hand piece, you will need to attach a test tip (HST02) using a torque wrench (TLB01) to the hand piece.

Press the STANDBY button to place the generator into the Ready State.

Press the TEST button.

The PM value for a good HP054 hand piece is between 170 - 247 Hz.

Note:
As the hand piece ages the PM decreases, therefore; if the PM is close to 170 hz or below, and some of the other parameters are close to their limits the hand piece is getting closer to its "end of useful life". Using a Hand piece that operates near its end of useful life may result in one or more of the following: (1) generator error codes (2) hand piece over heating (3) generator lockouts.



PM Value = _____

2.5 Record the value of |Zr| (Impedance)

Impedance can be found on page 8 of the BME service mode.

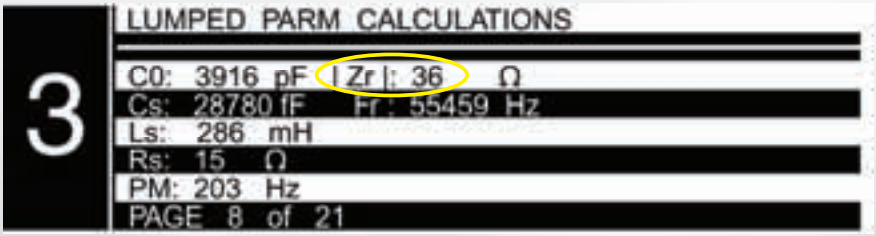
|Zr| is the value of the hand piece impedance.

The impedance will increase with the number of usages and cleaning procedures.

Make sure not to cool a hand piece in water; cool down only by time and air!

The impedance for a good HP054 hand piece with test tip, should be between 15 and 46 Ohms.

Note:
As the hand piece ages the |Zr| value increases, so if the |Zr| value is above 42 Ohms and some of the other parameters are close to their limits the hand piece is getting closer to its "end of useful life". Using a hand piece that operates near its end of useful life may result in one or more failures.



Note:
In order to record the impedance of the hand piece, you will need to attach the test tip using a torque wrench to the hand piece.

Press the STANDBY button to place generator in Ready State.

Press the TEST button.

|Zr| Value =_____

2.6 Error Display Mode (SW 1.09)

How to enter:

- Power up generator and firmly press the STANDBY and UP ARROW buttons simultaneously until error display mode appears.
- Plug in the hand piece.
- By pressing the hand activation button, you can toggle between generator and hand piece error display mode.

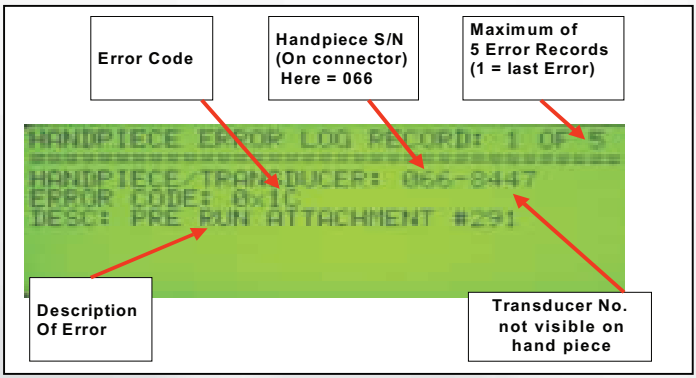


Fig.17 Error display- Modus: Hand piece errors

Note:
This error display mode will display the last 5 hand piece errors. Use the up and down arrows to scroll through the pages.

3 HARMONIC® Hand Piece HPBLUE

The generator drives the piezo ceramics by an electronic alternating signal. The piezo ceramics of the hand piece change the electronic signal into an alternating mechanical movement.

For the advanced Harmonic® system to work most efficiently, all components, e.g. the generator, hand piece and instrument have to function "harmonically". The generator continuously monitors the performance of the system components and measures the feedback from the hand piece.

After completing the screening process from this troubleshooting guide, you will know if your hand piece is working well or not.

You have to use a calibrated Harmonic® GEN 300 for testing hand pieces.

Follow the screening process very carefully.

3.1 Screening of Hand Piece HPBLUE

1. Attach test tip using a torque wrench onto the hand piece.

2. Check whether the mount is loose within the hand piece housing. To have a better lever and thus a clearer result, hold the hand piece with one hand and with the other gently attempt to move the test tip while the hand piece housing remains unmoved. If the mount is loose within the hand piece housing, the hand piece is defective and subsequent testing is not required.

Note:
Testing and/or operating a hand piece with a loose mount may result in various error codes being displayed (e.g. Error-Code-3 (hand piece) or Error-Code-5 (instrument) or Error-Code-4 (hand piece temperature).

Make sure the test tip is not visibly damaged.

3. Connect the hand piece to the generator.

4. Perform a user-initiated test by pressing the TEST button. If an error is detected, the hand piece is defective and subsequent testing is not required.

3.2 Service Mode for Hand Piece Testing

How to enter:

Power up generator and firmly press the STANDBY and DOWN ARROW buttons simultaneously until the BME service mode appears.

Caution:
Make sure to press BOTH buttons simultaneously, otherwise Generator "Error code #1" will appear (which will require you to power the generator down and then back up).

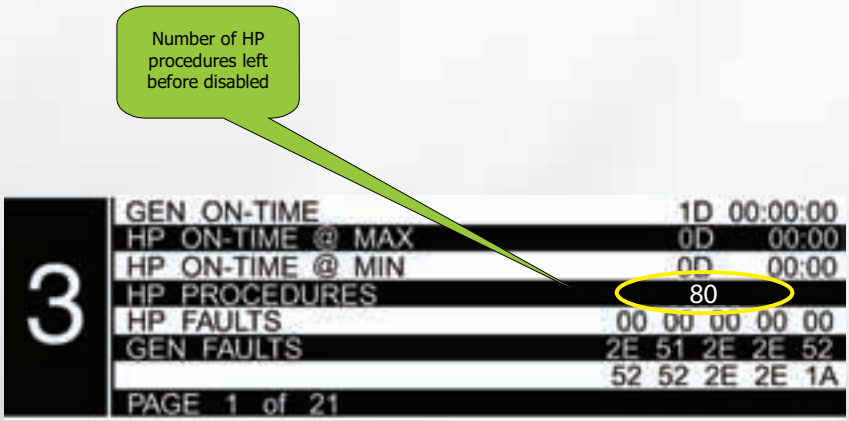
Operation in BME mode is identical to normal mode except for:

- The up and down arrows are used to advance through pages 1-21.
- LCD display.
- Clearing an error requires two presses of STANDBY in BME mode and only one press in normal mode.

3.3 Record the value HP Procedures

Perform the following while the generator is on standby:

For HPBLUE, HP procedures displays the number of procedures remaining.The field begins at 100 and counts down to 0. Once the hand piece reaches 0, it has reached the end of its life. When you activate the hand piece 10 times within one power on phase, this will subtract one procedure.


Number of HP procedures left before disabled
3
GEN ON-TIME 1D 00:00:00
HP ON-TIME @ MAX 0D 00:00
HP ON-TIME @ MIN 0D 00:00
HP PROCEDURES 80
HP FAULTS 00 00 00 00 00
GEN FAULTS 2E 51 2E 2E 52
52 52 2E 2E 1A
PAGE 1 of 21

Number of procedures remaining _____

3.4 Record the value of PM (Phase Margin)

Phase margin can be found on page 8 of the BME service mode.

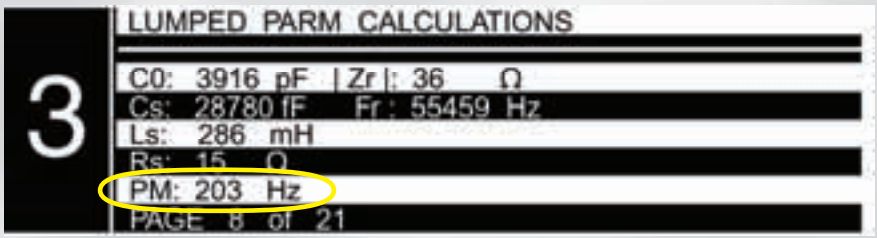
In order to record the phase margin of the hand piece, you will need to attach a test tip (TTBLUE) using a torque wrench (TWBLUE) to the hand piece.

Press the STANDBY button to place the generator in the Ready State.

Press the TEST button.

The PM value for a good HPBLUE hand piece is between 150 - 260 Hz.

Note:
As the hand piece ages the PM decreases; therefore, if the PM is close to 150 hz or below, and some of the other parameters are close to their limits the hand piece is getting closer to its "end of useful life". Using a hand piece that operates near its end of useful life may result in one or more of the following: (1) generator error codes (2) hand piece over heating (3) generator lockouts.



PM Value = _____

3.5 Record the value of |Zr| (Impedance)

Impedance can be found on page 8 of the BME service mode.

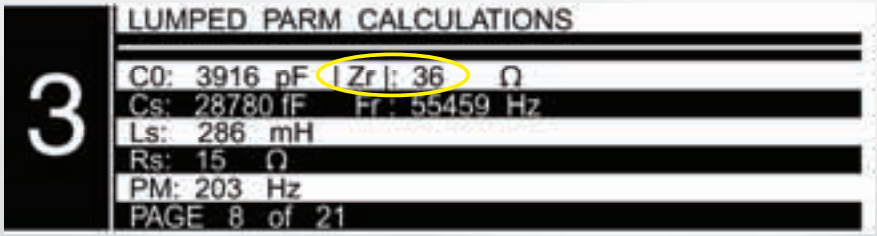
|Zr| is the value of the hand piece impedance.

The impedance will increase with the number of usages and cleaning procedures.

Make sure not to cool a hand piece in water, cool down only by time and air!

The impedance for a good HPBLUE hand piece with test tip, should be less than 50 Ohms.

Note:
As the hand piece ages the |Zr| value increases, so if the |Zr| value is above 45 Ohms and some of the other parameters are close to their limits, the hand piece is getting closer to its "end of useful life". Using a hand piece that operates near its end of useful life may result in one or more failures.



Note:
In order to record the impedance of the hand piece you will need to attach the test tip using a torque wrench to the hand piece.

Press the STANDBY button to place generator in Ready State.

Press the TEST button.

|Zr| Value =_____

3.6 Error Display Mode (SW 1.09)

How to enter:

- Power up generator and firmly press the Standby and UP ARROW buttons simultaneously until error display mode appears.
- Plug in the hand piece.
- By pressing the hand activation button, you can toggle between generator and hand piece error display mode.

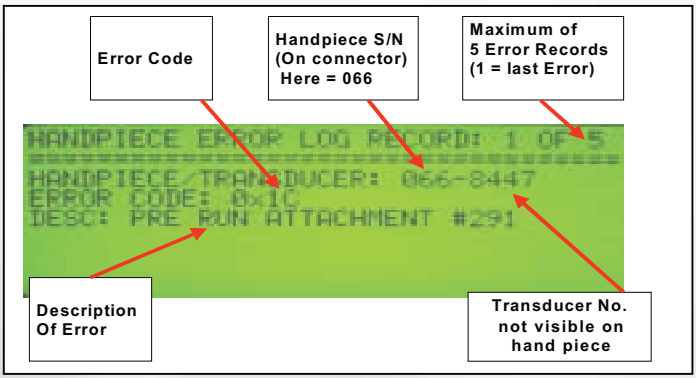


Fig.17 Error display- Modus: Hand piece errors

Note:
This error display mode will display the last 5 hand piece errors. Use the up and down arrows to scroll through the pages.

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ETHICON ENDO-SURGERY
a Johnson & Johnson company
4545 Creek Road
Cincinnati, Ohio 45242-2839

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